THE MODEL ENGINEER

Vol. 86 No. 2142

Percival Marshall & Co., Limited
Cordwallis Works, Maidenhead

May 28th, 1942

Smoke Rings

"Blitz" Philosophy

A WELL-KNOWN model engineer whose home town has suffered severely in recent air raids, writes me this sensible note:—"The people here think and talk 'Blitz' morning, noon, and night. I take great pains to divert their thoughts elsewhere, and this is where a man with a hobby has the advantage. My workshop is always in use during alerts, but on a crash I dash for the 'underground,' where I do a certain amount of mental planning for the next operation." I am very pleased to learn of my correspondent's safety, and especially pleased to hear of his "blitz" philosophy, which I hope will be followed by other readers in like circumstances. There is nothing worse than brooding over the risk of danger, and thoughts of a problem or a model make an excellent mental diversion.

Small Shops and War Production

MANY readers of THE MODEL ENGINEER, who are concerned with the management of small engineering enterprises, have formed the conclusion that the potential resources of the small shop have been very seriously neglected by the authorities responsible for war production. It is, perhaps, only natural that those whose duties are concerned with the organisation of the entire nation's industrial resources should think in terms of "big business"; but it is a great mistake to disregard the fact that the small engineering shop—even the one-man workshop—fills a very definite place in engineering industry, and is capable of adding by no means an insignificant quota to the national effort. While the small shop may not be suited to the production of immense quantities of standardised components—at least with the efficiency associated with large factories specially equipped for this purpose—it is a fallacy to suppose that all engineering, even under the high-pressure conditions existing at the present day, consists of "mass production." The development and trying out of the innumerable new war inventions (not only those directly connected with new weapons and armaments, but also many of less obvious but equally important application) which are vital to progress in the struggle for victory, often constitute a handicap to the large factory by holding up and disorganising production, but is all in the day's work to the small shop. The latter can also be set to work on a rush job very much quicker than the ponderous machinery of a large factory, and is much more adaptable to widely varying changes in the nature of the work which has to be dealt with. From actual experience and first-hand knowledge of some of the work which has been undertaken by readers of this journal, including amateurs who have devoted their workshop equipment and time to war industry, one cannot help but be convinced that their plea for more serious consideration by the authorities is no idle one. A very strong practical argument in favour of small workshops is that, previous to the war, most of them held their own in spite of very keen competition; and with the removal of this handicap, and working as co-operators with the larger firms instead of rivals, their capacity to speed the wheels of industry is beyond question.

Saving High-speed Steel

ONE of the most successful methods of making the best use of available supplies of high-speed steel for cutting tools is by welding carbon steel shanks on to the cutting portions of such tools as drills, reamers, end-mills, slot drills, and lathe tools. In practice it is found that this does not in any way effect their strength or efficiency, and results in the saving of as much as 50 per cent. of high-speed steel. How much this economy may be is shown by the fact that one firm alone saves at least 250 tons of high-speed steel a year by this method. The process used is that known as electric flash butt welding, in which the carbon steel shank is butt-welded on to the high-speed steel cutting portion of the tool. Fuller particulars of this process are given in an illustrated leaflet obtainable from the Controller of Jigs, Tools, and Gauges, Machine Tool Control, 35, Old Queen Street, London, S.W.1.

Percival Marshall

*Model Aeronautics

An Early "Wright" Biplane

Mr. Lawrence H. Sparey explains how to make the wings for a solid, scale, working model

AS the wings of this machine form the basis upon which the other component parts are mounted, we must start the construction of the two planes first. In model building of any kind it is seldom that an absolute duplicate of constructional methods can be attempted, because many parts which are strong enough in the large size are too flimsy and weak when reduced to model size. The great point, however, is not that the parts in question are the same, but that they should *look* the same. Our model wings therefore, will follow model constructional methods, with the "real" constructional features added afterwards as ornament.

Fig. 5 shows a plan of the wing; both the top and bottom planes are exactly similar. As a start we must make a full-sized drawing upon a sheet of paper, and, in these economical times, I would recommend that you use the back of a strip of old wallpaper, a roll of which may usually be found in most homes. The drawing gives all the details necessary, so I will only outline the actual making. The photographs, Figs. 6, 7 and 8, show that the wing ribs are curved, so that the first step will be to cut the 68 ribs to length, and bend them in the steam from a kettle. A bending template should be cut from a piece of thick cardboard, the rib being thoroughly saturated in the steam, and quickly manipulated to conform to the template. Fig. 9 shows the correct curve of the template.

Having obtained the ribs, the leading edge should be pinned on to the drawing on a board. The main spar, which lies near the trailing edge, must also be fixed to the board, but must be raised by jacking up with a length of ¼-in. × ¼-in. wood, as shown in Fig. 6. This packing piece is marked (X) in the picture, and is, of course, not actually part of the wing structure. Now cement the ribs across the spars, as is being done in Fig. 6, and when the cement is set, remove from the board. The wing in this stage is shown in Fig. 7. Two such wings are required.

Before describing how the wings of the model are joined together by means of the spars, I will digress a little, and explain how the spars were fixed to the planes in the actual machine. Readers of my last instalment will remember that one of the chief patents of the Wright brothers was the system of lateral control by means of warping wing tips. Virtually, this meant the alteration of the angle of incidence of the wing tips, as the need arose in flight, and necessitated, therefore, a very flexible wing. Under these conditions it is obvious that some flexible joint must be used between the spar ends and the wings, and I present a sketch (Fig. 10) which will show how this was attained. It will be seen that the spar end was enclosed in a metal cap which held a ring, which was, in turn, held to the wing by means of a clip. It will be readily understood that such a form of construction could only result in a wing structure which

* *Continued from page* 472, "*M.E.*," *May* 14, 1942.

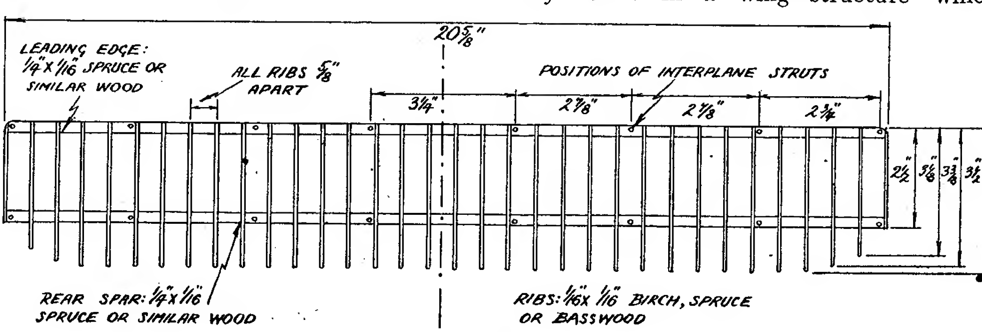


Fig. 5.

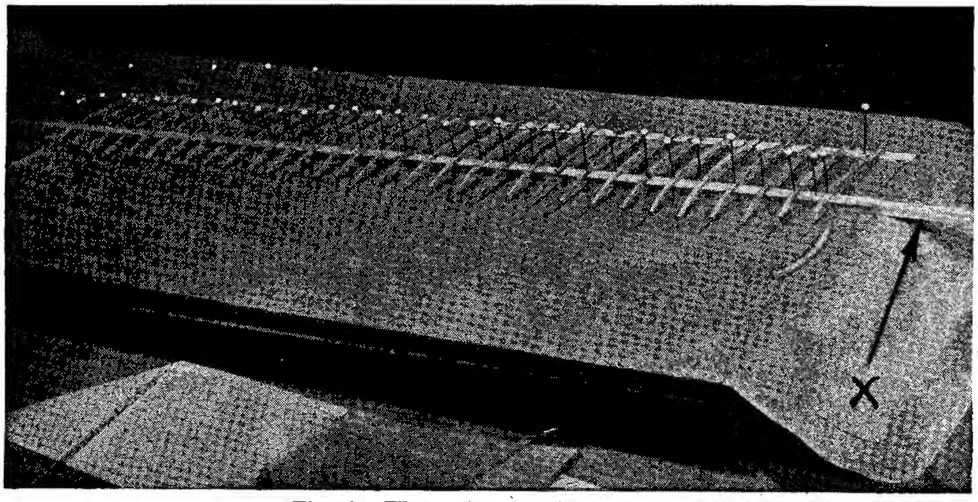


Fig. 6. Wing ribs pinned in position.

lacked rigidity in a horizontal plane, hence the necessity for the complicated system of bracing wires, which were well shown in the pictures of the model in the previous instalment.

From a model point of view, such a system is hardly practicable, because it would mean that the basis of the model—the wing—would be a loose, flopping structure, until the bracing wires were added. Were the bracing wires put into position, it would then be almost impossible to fit the many other small parts which lie inside the wires. Furthermore, small bracing wires on models are never of much practical use, because wire or thread of scale thickness is too delicate to take the necessary strain without breaking or stretching. On the model, therefore, I have fixed the wings rigidly to the spars, and have simulated the joints in another manner.

I am fortunate in having a friend who has for many years been connected with the aeroplane business, and who did, in his far-away youth, quite a considerable amount of work on Wright biplanes. He has told me that when the machine was on the ground it was possible to grasp the wing tips, and, with slight pressure, to flex the whole wing up and down in a most alarming manner. He says he well remembers the exploits of an American flyer named Beattie, who ran a flying school at Brooklands, and who was a great exponent of the capabilities of the Wright machine. This man used to do *vertical banks* on the Wright biplane. My friend says that when he remembered those " floppy " wings, the sight of such stunting used to give him the shudders !

Returning to our model, it is now possible to join the two wings together in a biplane construction. For this purpose it is necessary to cut 16 interplane struts of bamboo, such as is shown in Fig. 11. These taper slightly towards the tips. Now cut a number of strips of tin foil, $\frac{1}{8}$ in. in width, and wrap a couple of turns of the foil strip around the ends of the struts, sticking them down with cellulose cement. These will imitate the metal sockets. Fig. 12 indicates the manner in which the flexible joints are simulated. A small hole is bored through the end of strut, and a piece of soft copper wire is pushed through this hole and bent in the manner shown.

The lower plane is now pinned down to the building board, and the four centre

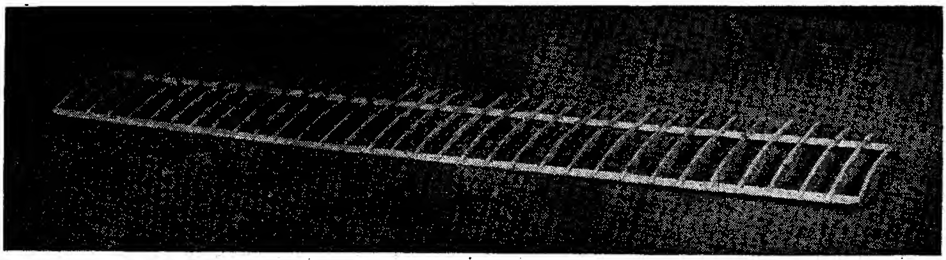


Fig. 7. Finished wing framework.

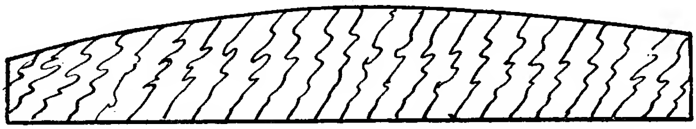


Fig. 9.

struts are cemented to it in an upright position. Now add the two end struts at both ends of the plane. Let the cement almost set, then place the top plane upon the ends of the upright struts, and secure each with a touch of cellulose cement. Put the structure aside for about an hour to allow the cement to harden, but first check that the structure is "square" in all directions, and that the top plane is directly over the lower one. Before the cement sets-off it is easy to move the structure in any direction to ensure squareness.

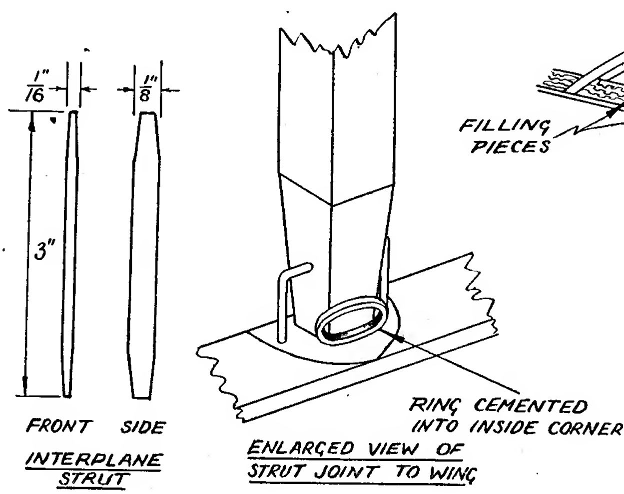


Fig. 11.

When the cement is hard, the remaining inter-plane struts may be added, when you have a structure resembling that shown in Fig. 8, except that the centre planking has not yet been added, and that your replica will have only eight pairs of struts instead of the ten shown in the picture. The reason for this difference has already been explained.

To finish off this part of the construction it is necessary that the ends of the copper wires, which were inserted into the wing struts, be bent down to touch the spars of the wing, where they may be anchored with a light touch of cement. In addition, the leading edges of the two planes must be built up to the height of the ribs, by cementing in small pieces of wood between the ribs, as is shown in Fig. 13. Balsa is the best and

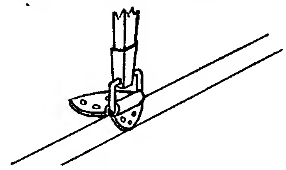


Fig. 10.

most easily worked material for these small filling pieces, but almost any other wood will do if balsa is unobtainable. Finally, the filling pieces are sanded down to make a smooth, level top to the leading edges.

In the finished model a very considerable number of bracing wires must be stretched between the bays of the wings, and for this purpose some form of anchorage for the wires must be provided at the tops and bases of every interplane spar. For this purpose I used thin rings cut from a length of ⅛-in. bore celluloid tubing, which is still obtainable

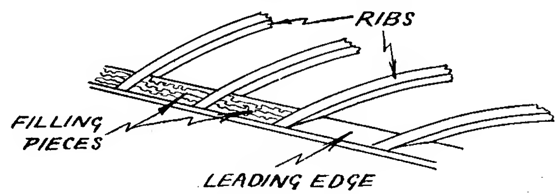


Fig. 13.

from most of the model supply stores. In default of this, a tube may be made by rolling a strip of gummed-paper parcel tape around a ⅛-in. knitting needle. The paper tape should be well wetted and wrapped around the needle in the same manner as that used for rolling a cigarette; the needle being instantly withdrawn to prevent it sticking to the inside of the tube. The tube thus obtained must be put aside to harden thoroughly for 24 hours; the rings may then be sliced off with a safety-razor blade. They are then cemented, at an angle, to the

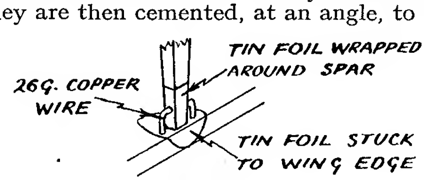


Fig. 12.

inside junction of the spars and the plane, as may be seen in the drawing, Fig. 11.

Fig. 8 shows that the middle section of the lower plane is sheeted over, either with 1/32-in. sheet balsa, or with a similar thick-

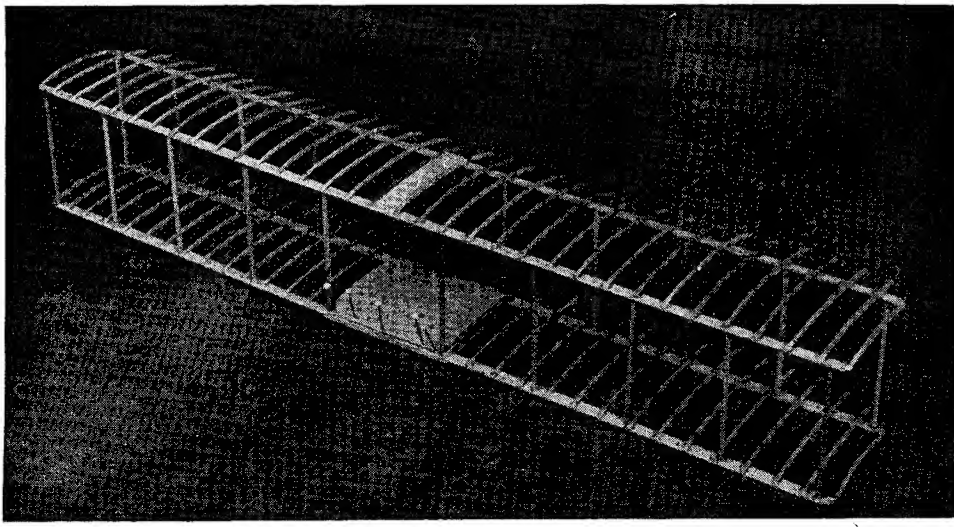


Fig. 8. Primary structure of the biplane wings.

ness of basswood, which is now largely replacing balsa in model aeroplane construction. Both the top and bottom surfaces of the lower plane centre-section are sheeted over, as may be seen. In addition, the space between the two centre ribs of the top plane is filled in with a strip of wood, flush with the top of the ribs, as may also be seen in the picture.

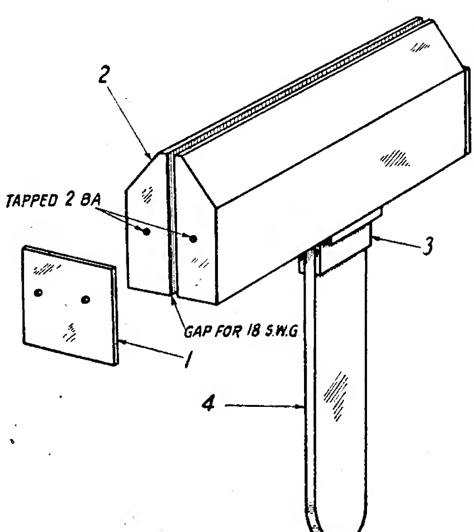
(To be continued)

HAND FOLDING TOOL FOR SHEET METAL

I MADE this tool some time ago for one special job, but which like many others, have found with special tools, has come in so handy since, that I think some readers would like to make one similar.

The job I had to do was something like a tin lid in 20 S.W.G. aluminium, three edges turned up square and welded. Three edges went up all right in the folding machine, but the fourth edge wasted a lot of time, until I thought of this handy tool, and then I did not even need the folding machine for any of the edges.

As can be seen from the sketch, two parts of items 1, 2 and 3 are required and one of part 4; all these are bolted together and then welded or brazed.



I have given no dimensions, as this can be made any size from odd pieces of steel plate. Mine is 3-4 in. long and will take 18 S.W.G., a tight fit between the plates.

If only bending small edges, all that is needed is a piece of plate dropped into the slot to make the required depth, then only the first one off will require marking, as the others cannot go wrong.

By the way, I have called this a "Hand Folding Tool," but now when I use it, I nearly always put the handle in the vice.—A.F. PHELPS.

Just a Traction Engine

Description by R. EDWARDS

Photographs by C. B. CARLYLE

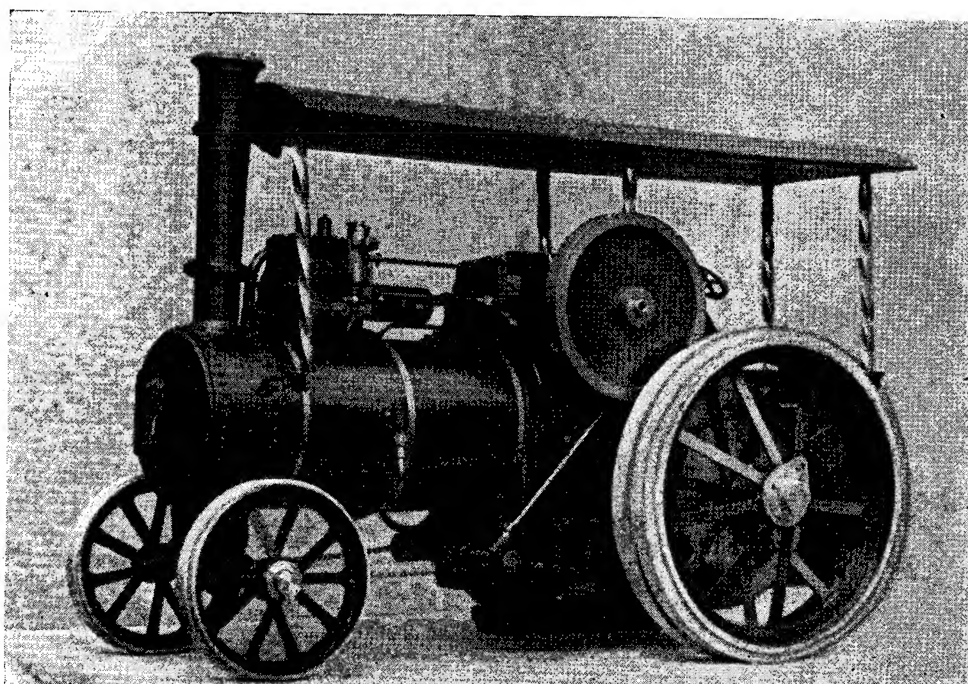
THE following is a description of a 1¼-in. scale traction engine; to start with the boiler, which is the real foundation of an engine of this type, this is built entirely of copper, and is silver-soldered and is built according to "L.B.S.C." specifications, including a spearhead super-heater, therefore no detailed description is necessary.

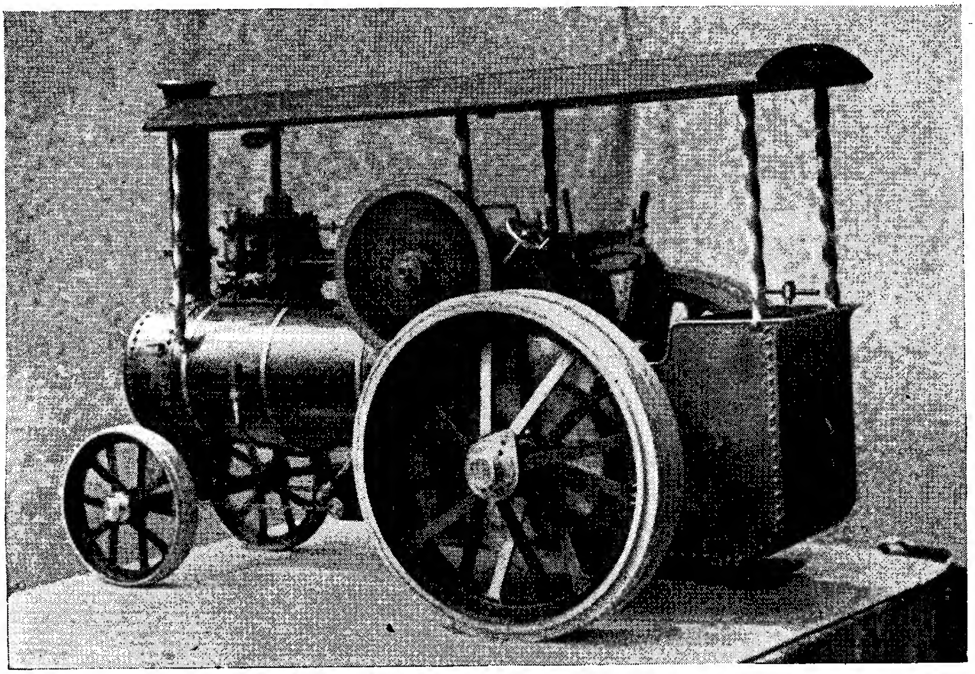
The cylinder is a gunmetal casting, and is of 1-in. bore by 1¼-in. stroke, and is fitted with an aluminium alloy piston, which has proved very satisfactory in service; the exhaust pipe is led down into the smokebox and has a 7/64-in. blower jet on the end; it was felt that the practice of leading the exhaust steam straight into the chimney would not be efficient enough for a model.

The valve-gear, which is Stephenson's link motion, is exactly the same as described by "L.B.S.C." in THE MODEL ENGINEER for the "Purley Grange" loco., some time ago, the only difference being the method of lifting the link, which is lifted from below instead of the centre. The hornplates are of ⅛-in. steel plate, and are bolted to the firebox by means of the firebox stays, which were left long enough for this purpose. Extra support is gained from 3/16-in. steel strips, which are bolted across the foundation ring and on to the hornplates; thus the boiler sits in a sort of cradle. The plates need to be very secure, as not only do they carry the thrust of the crankshaft, but also practically the whole weight of the engine (which in this particular case is 50 lb.).

The tender is built up of 16-gauge steel plate, and is edged with half-round brass wire; a zinc water tank made to fit inside carries a pint of water, and, of course, is fitted with a removable strainer. The water pump, which is of 5/16-in. bore, is gear-driven from the crankshaft, the gear reduction being 2½ to 1. This is the usual practice in modern road locomotives, and it has been found that pumps driven at half crankshaft speed are more efficient; anyhow, my pump keeps the water nicely up to the "top nut."

This is a three-shaft engine; I had the gears by me, with the exception of the large gear on the back axle, which required some 130 teeth, and, of course, had to mate up with the rest of the gears, which were 32





D.P.; therefore, a special cutter was made. A silver-steel blank was turned to the profile of the gear with which it had to mesh. Next, teeth were milled and the cutter was hardened and tempered, and proved very satisfactory. The gear was made from a gunmetal casting, and for this gear-cutting effort, which was a first try, I am indebted to Mr. C. B. Carlyle, a model engineer in my district.

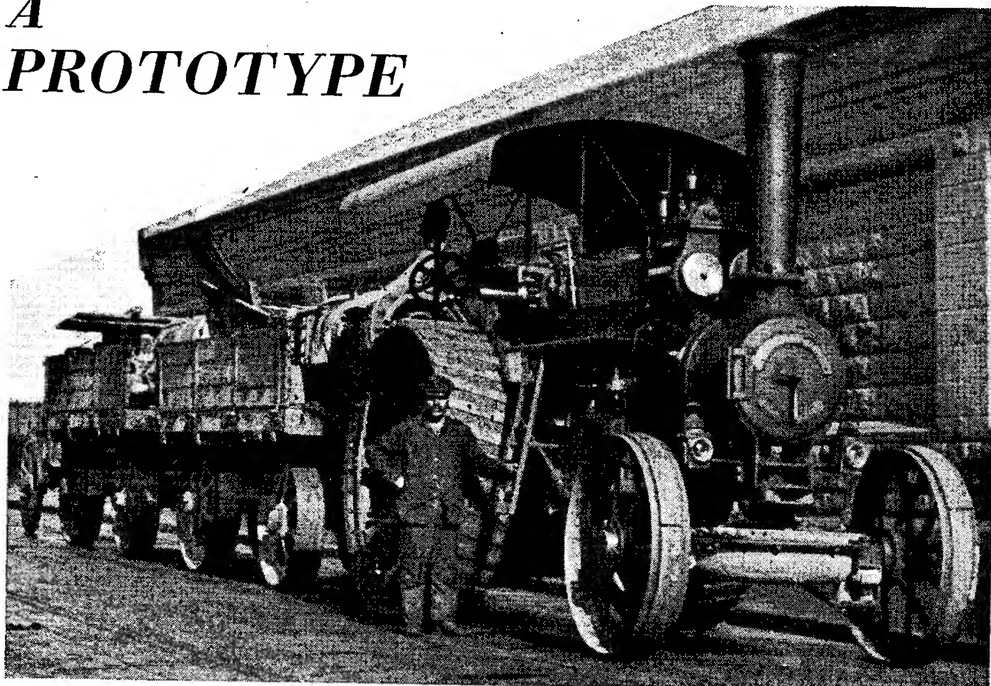
Perhaps the method adopted for building up the wheels may be of interest. I pondered for some while over this problem, as traction engine wheels present many difficulties to the tyro; it seemed to me that some sort of jig was necessary, as no matter how carefully one marked-off, drilled, and bent the spokes, it would not be possible to build a wheel that was in any way true. The rims were forged up from $1\frac{3}{4}$-in. by $\frac{1}{4}$-in. M.S., by the local blacksmith, and are 8 in. in diameter. The rims were first cleaned on one side, and three pieces of brass sheet soldered to the rim; this enabled me to bolt up to faceplate and turn on the outside, inside, and the periphery. The rim was then reversed and the other edge turned; both rims were completed in this manner.

It being impossible to obtain T-section metal, some brass angle was obtained, and used for the spoke rings; as can be imagined, bending angle into a circle is not too easy, as it has a very great tendency to twist. However, it was successfully accomplished by means of an oak disc which was turned to fit inside the rim, less twice the thickness of the angle, and a groove turned in the periphery to accommodate one leg of the angle, which was well and truly annealed. One end of the brass was then fixed to the wood by a small screw and the brass worked around by lightly striking with a small hammer; when complete, they were sprung into the rims and riveted with 1/16-in. rivets, the rings being held meanwhile by toolmakers' clamps.

Spokes were cut from 3/32-in. M.S. plate, 16 for each wheel, and the hubs were turned from steel bar and drilled for the axle, 1/16 in. undersize. We now have all the component parts for a wheel, and to assemble a disc of oak was turned half an inch larger than the diameter of the wheel; in this a step was cut so that the wheel rim was a tight push fit over this, then at the same setting a recess was bored to take the hub, again a tight fit. When assembling, the hub was squared off from the surface of the disc to make quite sure it was vertical. Eight spokes were then carefully bent and laid in position, one end inside the spoke ring and the other outside the hub flange; these were then carefully soldered in position, and then the wheel was reversed and the other eight spokes done likewise. Thus, we have the whole wheel assembled without any chance of it being pulled out of shape.

(Continued on next page)

A PROTOTYPE



ONE of the sidelights of war-time conditions has been a fairly wide revival of interest in traction engines. It is certain that, in country districts, the traction engine can be seen more frequently than was possible for some years immediately prior to the outbreak of war. But even so, these interesting machines are seldom found on the roads; their use is now usually confined within the limits of farms, ploughing or threshing being their principal duties.

Referring to recent references which have appeared in THE MODEL ENGINEER, Mr. A. J. Fellows, of Polegate, has sent us the photograph reproduced herewith. It was taken on October 1st, 1907, and shows a Fowler engine about to leave Penzance with a "tow" of two trucks loaded with machinery for the Old Botallack Tin Mines, near St. Just, on the north-west coast of Cornwall. Mr. Fellows states that he made a trip "on the footplate" with the driver, Mr. Naboth Osborne, and travelled from Penzance to the mines. He also spent some time with the miners "down below."

This interesting photograph shows certain details which may be useful to many of our readers.

Just a Traction Engine

(*Continued from previous page*)

The next item was to mark off and drill the rivet holes and rivet up with 1/16-in. iron rivets. The wheels were now returned to the faceplate, held in position with faceplate dogs, and carefully set up to run dead true by means of a test indicator; the hubs were then very carefully bored out to a nice running fit on the axle. This completed the hind wheels, and on trying on the axle they ran dead true; the same methods were used for the front steering wheels.

I have dealt at some length on the subject of wheels, as it is an item which I have never seen described, and is, in my opinion, one of the most important items on a traction engine.

Rubber tyres are fitted instead of strakes, as it was thought that the engine would ride much better; this is quite correct practice and rubber tyres are fitted to many modern road engines.

My idea in building this engine was to have it first and foremost as a working model, and in this it has proved very successful and has travelled many miles. It will easily haul two adults and keep going continuously, the chief trouble being to keep the steam pressure down; no trouble whatever is experienced with the fire; I find it will burn almost any coal. Anthracite is the chief fuel that I use.

This model has taken about eighteen months to build (spare time, of course) and is entirely my own design; no particular prototype was followed, it is just a traction engine, which has given me many hours of pleasure both in building and running.

"Molly's" Running Boards

By "L.B.S.C."

WHEN the tanks are made and erected, the injector can be made and fitted, all outside pipe work put on, and the steam brake connected up without having to do any further "fiddling about," so we will make that part of the "top works" our next job. First we shall need the platforms or running boards on which to erect the tanks. They want to be fairly stout, so use 16-gauge metal. Anything you can get will do—hard-rolled brass, blue steel, or galvanised iron plate are all suitable. Cut out two strips each 21¼ in. long, and 1 13/16 in. wide, and have them as flat as possible. Three segments, each 2¾ in. long and 9/16 in. wide, must be cut out of one edge, to clear the wheels; the positions of these are shown in the sketch.

For novices' benefit, the easiest way to cut them out, is to grip the metal in the vice, with the base line just showing at the top of the jaws. With a fine-toothed hacksaw, cut down the line at each side, as far as the base line; then take a small chisel, which you can easily make yourself from a bit of ¼-in. silver-steel. Apply the cutting edge to the bottom of one of the sawcuts, holding the chisel on an angle; and keeping the cutting edge down to the vice top, hit the other end with a hammer. The way the chisel will shear off the sheet metal will surprise novices and beginners; you will be through to the other saw-cut just as quickly as I write this. The trick is to hold the chisel at an acute angle to the sheet metal, so that it cuts with a shearing action; not at right-angles to it, which would only result in distorting the piece and not cutting it. When all six are cut, trim the ragged edges with a file, to the given dimensions.

I have not shown a separate drawing of the edging or beading, as this can be seen plainly in the general arrangement of the engine published some time ago, and is merely a length of ⅜-in. by 1/16-in. angle which runs the full length of the platform between the buffer beams. The length of each piece is 20⅞ in., and it is riveted to the underside of the platform ⅛ in. full from the edge. At each end this beading is deepened to ⅞ in. for ¾-in. length at the front end, and ⅜ in. at the back; and this can easily be done, by soldering on pieces of 1/16-in. sheet brass, filed to the shape shown in the illustration mentioned above.

Leading Splashers

The splashers over the leading wheels can be made of the same kind of material used for the platforms, and the size and shape of these are shown here. Cut out the side piece first, then cut a strip ⅝ in. wide, and bend it to a radius which will fit the top of the side panel for its full length. Anybody who has an oxy-acetylene blowipe with a small tip, can hold the bits together with a home-made clamp, and run either Sifbronze or ordinary brass wire all around the joint. I find this actually easier than soft-soldering, besides being infinitely stronger; but those who haven't the necessary blowpipe can fall back on "soft Thomas" as there is neither heat nor pressure to upset the joint.

If iron or steel plate is used for the splashers, clean well with a file before soldering, and use a liquid flux; apply the soldering bit to the inside of the splasher, and leave a fillet of solder in the joint. The completed splashers can either be Sifbronzed or soldered over the first wheel gap, or the top strip can be left long enough to leave a small lug at each end, by which the splasher can be attached to the platform by rivets or screws. Warning: don't go and make two right- or two left-hand platform or running-board assemblies. You think that is superfluous? Well, I know several cases where it has been inadvertently done, tanks and all, and it is done much easier than most folk would imagine!

The whole doings can then be erected on each side of the frame, with the splashers covering the leading wheels. A couple of ⅛-in. or better still, three 3/32-in. countersunk screws put through clearing holes at each end, into tapped holes in the tops of the buffer beams, will make all secure; whilst the centre part can be supported by brackets made from ⅜-in. by 1/16-in. angle, about 1 in long, screwed to the frame between the coupled wheels. Two more 3/32-in. countersunk screws can be used to attach the platforms to each angle bracket. There is no need for the brackets to project out the full width of the platform, as the angle edging makes it stiff enough to be self-supporting at its extremity.

Side Tanks

Brass or copper should be used for these, although galvanised iron would do at a

pinch. Ordinary steel is not much good for the job, on account of rusting. Sheet metal of 20 gauge is strong enough, but there is not the least objection to using something stronger, say 18 or even 16, if that is all that is available. Each side sheet is made in one piece with one of the ends, a pet construction which I like, as it does away with two corner joints. The outside sheets need a piece of metal 12 9/16 in. long and $3\frac{1}{8}$ in. wide. Mark off the ends as shown in the illustration, and cut out the curved piece where the end of the tank butts up against the boiler, trying it in place to make certain it fits snugly and leaves no ugly gap. Then bend at right-angles on the dotted line, making the bend in the opposite direction on the second tank, so you have a proper pair. Grip in the vice with the dotted line level with the tops of jaws, and bending is then dead easy; but when you hammer the bend to make the angle sharp, be careful not to dent or otherwise deface the metal, as nothing looks worse than a bit of sheet-metal work which looks as though the workman responsible had called at the "Railway Tavern" before doing the job. The use of a hide hammer (we called them "bacon-rind" hammers) or a mallet, is good insurance against damage.

The pieces of metal forming the sides of tank next to boiler, are shorter, being only $10\frac{3}{4}$ in. long, and the back end is bent at right-angles for a length of $1\frac{1}{2}$ in. At $3\frac{3}{4}$ in. from the straight end, mark off a vertical line and, using this as a centre, strike off an arc with a pair of dividers set at 2 in. radius. The top of this arc should be 9/16 in. above the bottom of the tank side, and the length between the points where it intersects the bottom of the tank side, should be $2\frac{3}{4}$ in., see illustration. Cut the piece out, and then take another "bite" out of the bent corner, as shown, to clear the trailing wheel. This bit may be straight. Next make up a couple of brass splashers as described above, only a shade smaller; same radius, but $\frac{3}{8}$ in. wide and 9/16 in. high, as the tanks do not touch the frames, and space must be left for the bottom plate, as shown in the section. Solder one of these splashers into each recess, and fit two little triangular "boxes" into each of the cut-away corners.

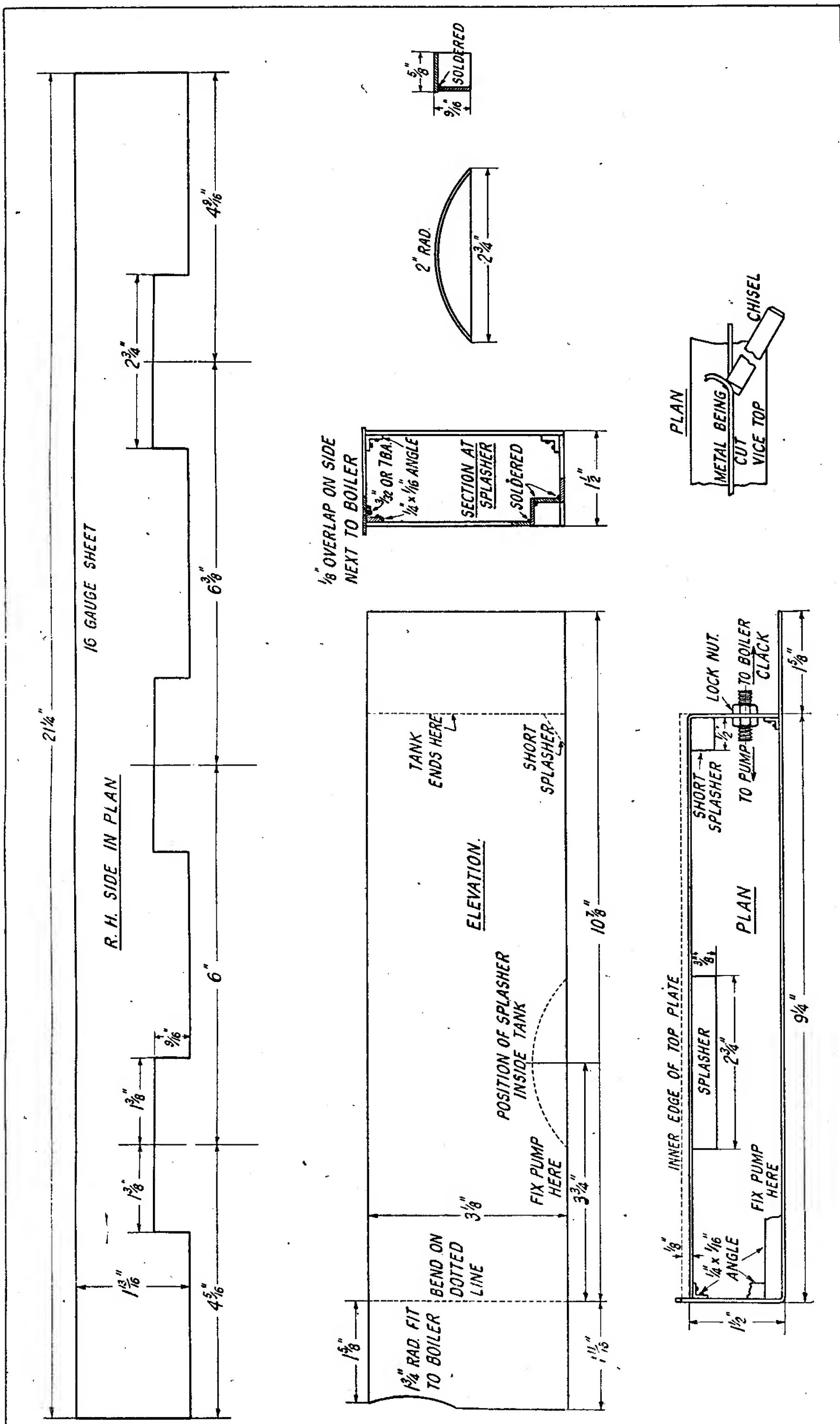
The tanks can then be assembled, and the plan sketch shows how this is done. The two sections are placed together to form a sort of box, the straight end of the inner sheet butting up against the shaped end of the outer one, whilst the bent end comes up against the outer sheet at $1\frac{5}{8}$ in. from the back end. This is to allow plenty of room in the cab. If the tanks were made full width right back to the cab doorway, there would be no room for the reverse lever and other gadgets. A piece of $\frac{1}{4}$-in. by 1/16-in. angle brass is riveted and soldered into each corner.

Again for novices' benefit, the easiest way to assemble these parts is to bring the pieces together—side and end plates, and piece of angle—put a small toolmaker's cramp over each side plate and the angle (these cramps can be home-made, using $\frac{1}{4}$-in. square brass or steel rod, and $\frac{1}{8}$-in. screws) and tack each end with solder. The cramps can then be removed, a few No. 51 holes drilled through side plates and angles, and 1/16-in. copper or brass rivets put in. As there are no rivet heads ornamenting (or disfiguring, according to taste!) the tanks on "Molly's" big sisters, countersink the holes outside, hammer the rivets well home, and file off flush. Remember to hit the rivets and not the plate.

The bottom of each tank is made from a piece of 16-gauge sheet brass or whatever metal you are using, cut to fit inside the tank at the bottom edge, pieces being cut out of it to clear the splashers. Let this in flush with the bottom, and solder it. I have shown it angled in the section, but this is optional; if a good fit, soldering will be quite sufficient to keep it in position and prevent leakage, as it is supported by the platform or running board. The hand-pump won't rock it, either, because the four screws holding the hand-pump down can go right through both tank bottom and platform, and be nutted under the latter. This wheeze will kill two sparrows with one shot, as there won't be any need to provide separate screws to hold the tank in place.

The emergency hand-pump goes in the left-hand tank, with the handle up at the front end, so that it can be worked through the filling hole. If you file a tiny shade off the lug of the pump stand at the valve-box end you will find that the whole issue will go in very nicely, with the beforementioned lug between the splasher and the side sheet. A double ended union, with $\frac{1}{4}$-in. by 40 threads, same as I specify for the emergency pump connections underneath $2\frac{1}{2}$-in. gauge tenders, is fixed in the end of the tank nearest the cab, and connected to the union on top of the valve box by a 5/32-in. pipe furnished with the usual union nuts and cones; and after the tank is fixed in position, a similar pipe connects the outer end of the double union with the adjacent clack on the boiler backhead.

The top plates of the tanks are fitted pretty much the same way as I specify for the detachable tops at the rear end of tenders. Pieces of $\frac{1}{4}$-in. by 1/16-in. angle are riveted to the ends and sides, along the top edges, and flush with them. They will not need soldering, as the water level is never carried to the extreme brim. The top plate of each tank is made from a strip of the



Details of superstructure for "Molly."

same kind of metal as bottom and sides, and measures 9 5/16 in. by 1 ⅝ in. It is attached to the angles by 8 B.A. or 3-32-in. countersunk brass screws at 1-in. centres, the screws going through clearing holes in the plate, into tapped holes in the angles.

Note that on the outside of the tank the top plate only just barely overlaps the side sheet; but on the inside it overlaps by ⅛ in., to fill up the space between the side sheet and the boiler. Set the handle of the hand-pump vertical and mark off the top plate the exact position of it; then, using the marked place as a centre, cut an oval hole about ¾ in. by 1¼ in., and using this as a template, cut a similar hole in the top plate of the tank on the other side. The lids covering these holes are made exactly the same as the firehole door, except that no spring catch nor baffle will, of course, be needed. The big "Mollies" have a clamping screw to keep their tank lids closed when running; if you are scared of Inspector Meticulous you can fit them, they are only little hinged stirrups with a screw through the middle, but they are really not necessary.

You can't go wrong when erecting the tanks, as the splashers come exactly over the driving wheel slots in the platforms or running boards. Stuff the space between tank sheet and boiler with felt or asbestos, or even flannel (did I hear somebody say make them "flannel jackets?") so that the water in the tanks does not cool the boiler, nor the boiler heat up the water in the tanks and prevent the injector fulfilling its mission in life. The tanks should come to within 1/16 in. of the edges of the platforms. As mentioned above, the hand-pump fixing screws will hold the left-hand tank in place, and the other can be fixed by a couple of ⅛-in. brass screws, one near each end, passing through the bottom of the tank and the platform, and having nuts underneath. A smear of plumbers' jointing around the screwheads, before inserting, will effectively prevent any leakage of water.

How Curly's "Stage Fright" was Cured

I must offer apologies to those followers of these notes who keep clamouring for more about poor Curly and his adventures; but as I remarked before, the poor old noddle that once carried Curly's golden "mop" is finding it some job to go back through the years and correlate all the incidents. However, I'll still do my best! Well, the three weeks following my visit to the locomotive sheds dragged by on what the novelette writers call "leaden feet." I told the driver about the trouble I had at school on the day following my "initiation," and he grinned and said we'd better not let that happen again, so he fixed the date of my next trip for the fourth Friday, as I didn't have to go to school on the Saturday. In the interval, I took advantage of the stationmaster's kind offer, and spent about an hour on the platform, on two separate evenings, watching the engines.

The two porters and the ticket-collector made friends with me, and I felt "quite at home" with them, especially after being invited into the porters' room and given a cup of tea and a cake. The stationmaster himself pointed out the different classes of engines. I recollect being very intrigued with one which had no cab, only a bent-back weatherboard; a very tall dome, nearly as high as the chimney, and the frames outside the wheels. The stationmaster said it was an old "Craven," and that there were not many of them left. I don't recollect ever seeing another engine on the Brighton without a cab, so the one that came through that evening was probably "the last of the Mohicans."

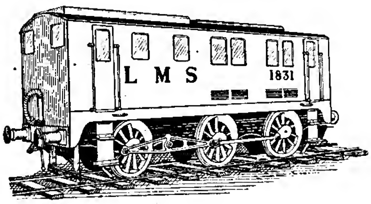
"All things come to those who wait," says the old saw, and the Friday duly eventuated. The driver told me to wait on the down platform this time, and go to Peckham Rye first. As the evenings were now longer and lighter, I could then take a turn at driving on the open section, and learn the signals in the tunnels before I tried my 'prentice hand on that bit. I wanted to learn to use the shovel while the engine was running, as I had the strength, so he said I could do that also on the tunnel section. After my previous experiences, visiting the driver at home, and going to see the engine at her home too, I did not expect any recurrence of the "stage fright" business, but, nevertheless, it persisted, for when little *Stepney* pulled in, I felt almost as scared to step into the cab as I did on the previous occasion. The driver said to the fireman, "My relief's turned up, mate," and sat down on the trailing sandbox inside the cab; I stood there looking and feeling very helpless. The guard blew his whistle; the driver made no attempt to start, but grinned and said, "Right-away, Curly, get on with it."

Now, if I do anything under stress of great emotion or excitement, even to this day, I just can't recall it; it is just like a page torn clean out of the Book of Memory. I don't recollect exactly what happened then, but I heard the tale some time after I went to work on the railway, just as the driver told it, either in the lobby or in the "local," where they held the "branch" meetings. He said, "The kid wasn't *really* scared; he only *thought* he was, being brought up like a girl, shy and timid.

'Scotty' (that was the stationmaster)

(Continued on page 520)

Construction of Transmission Gear



By EDGAR T. WESTBURY

THE various components of the transmission system are mostly of a straightforward nature, and can be made from common materials. Comparison with the general arrangement drawings will reveal one or two minor modifications, and in some cases it is possible to introduce alternative specifications or methods of construction, which will be duly referred to as and where they arise.

Bolster

This is the most massive component in the entire assembly, and therefore may well be disposed of first. Its form, as shown in the detail drawing, Fig. 110, is most readily produced from a casting, which may be made in gunmetal, iron, or anything available; but if it happens to be more convenient to build it up, it may be made from brass or steel stock, comprising two side plates of 3/16 in. sheet, two pieces of $\frac{1}{2}$ in. and $\frac{1}{4}$ in. rectangular bar for the cross members, and one piece $\frac{3}{8}$ in. thick by 1 in. square for the dropped bearing housing. The cross section need not, in this case, conform exactly with the shape shown in the drawing, so long as the relative positions of the essential parts are maintained; the side plates are cut out with dropped lugs long enough to provide bending allowance, and the latter are joggled inwards to fit the width of the housing block, allowing the curves and angles to come as they will so long as they are true and symmetrical. The assembly is then pinned together and brazed or welded up.

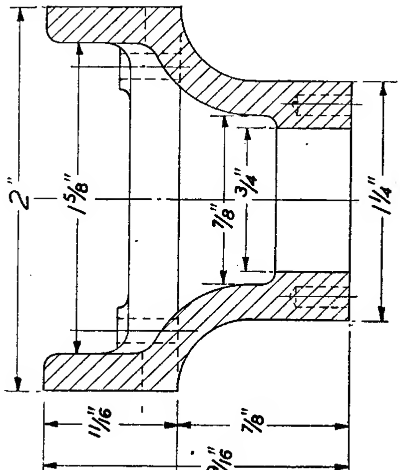
In machining the bolster, the same methods may be adopted, whether a casting or a built-up structure is employed. The top edges of the side strips should first be trued up, either by filing or machining, so that they are quite straight and parallel, and form a reference surface for subsequent setting-up operations. The component is then clamped to the faceplate with the top edges in contact; a single bolt with a bar or "strap" across the narrowest part of the two side strips will be sufficient to hold it quite firmly. Set the work up so that the centre of the bearing runs quite truly; face the under surface, drill and bore it out to take the ball race. The type of ball race intended to be fitted is the SKF EE2 ($\frac{1}{4}$ in. bore by $\frac{3}{4}$ in. o.d.), or any other good quality race of similar specification. This has been specified for all four bearings of the transmission system, as it is a very popular type, and the most likely to be readily available. A rather more suitable race for the particular purpose is the SKF 13301 (6 mm. bore by 19 mm. o.d.), which is of the self-aligning type, and therefore capable of accommodating possible errors in the structural accuracy of the transmission frame. It is even possible to fit a larger bearing of this type, the SKF 13303 (8 mm. bore by 22 mm. o.d.) with proportionate advantage in wearing life and load-carrying capacity; but both these races may be rather difficult to obtain under present conditions. Some constructors may even find it impossible to obtain any ball races at all, and before dismissing the subject, I shall have something to say about possible alternative types of bearings for this job. In all cases it should be remembered that any departure from the specified type of bearings entails some modifications in the housing and the shaft which runs in it, so that a decision on the matter must be reached before the machining of these parts is carried out.

In fitting the races to the housings, I always recommend slightly finer limits than the makers specify, not because I consider that the latter do not know how to fit their own bearings, but on the principle that it is much simpler to ease a tight bearing than to tighten a slack one! If the races are fitted so that they can be tapped through the housing with the *shaft* of a light hammer, there is little risk of causing them to distort and bind. If an old race, or the outer ring of one, is at hand, it should be used as a fitting gauge, and by pushing it through the housing two or three times with a press or a drawbolt, it will produce a burnished seating for the race which is to be used eventually. Too much care cannot be devoted to the fitting of ball races in any machine, and above all, when they are finally inserted, the utmost precautions should be taken to put them in dead square with the axis of the housing. By far the majority of ruined races, and ball-bearing failures generally, are caused by imperfections in this respect.

* *Continued from page* 467, "*M.E.*," *May* 14, 1942.

While the bolster is clamped to the faceplate a skim should be taken over the lower faces of the cross bars. The one nearest the housing may not be accessible to machine all over, even if it is set out to the maximum possible radius, as the tool would cut into the side strips; but if a part of it only can be skimmed, the surface produced will act as a "witness" to indicate the correct level to which the rest must be filed, or otherwise machined.

The side faces of the bolster should now be machined by clamping it, in the same way, to an angle-plate bolted to the faceplate, and taking a cut right across each side in turn with a facing tool. Care should be taken to produce exactly parallel sides, which is quite an easy matter, by measuring from the faceplate. The width of the bolster should be adjusted so that it will just slip between the side plates of the chassis sub-frame, and the bearing housing should be exactly central between the two sides. If, however, an error in this respect is found to exist when machining is complete, it may be allowed for when machining the upper vertical shaft housing. Quite obviously, it is essential that these two housings should be exactly in line, but rather less imperative



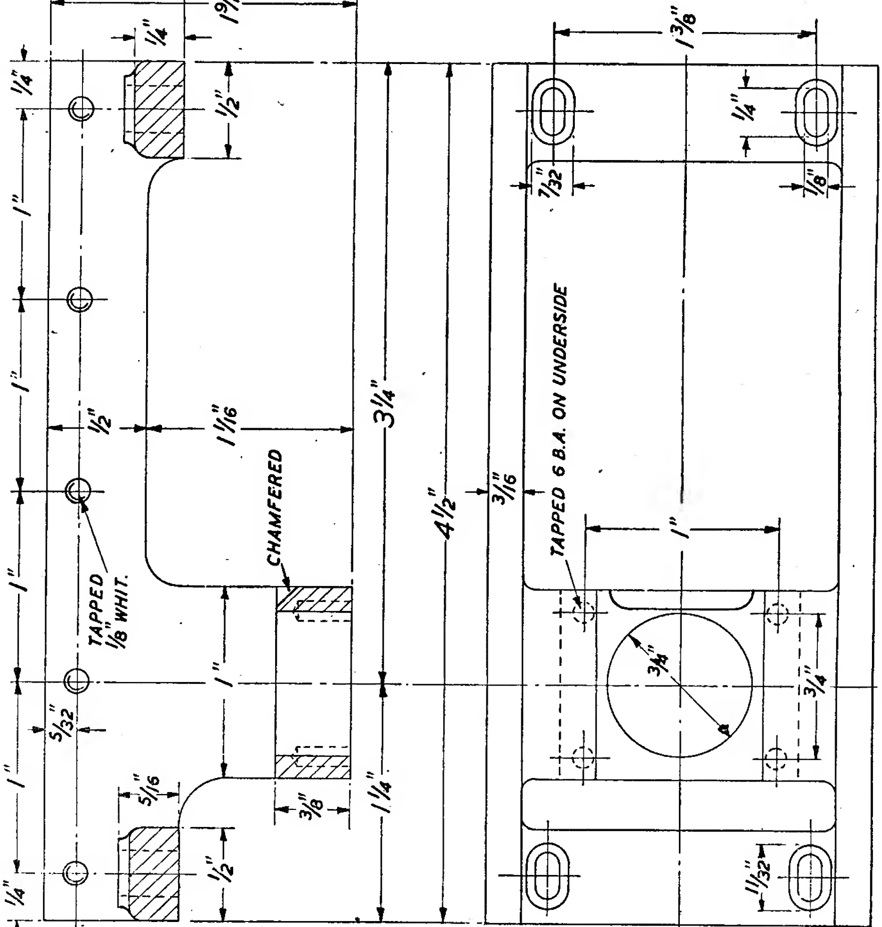


Fig. 110. Details of transmission frame bolster.

that they should lie exactly on the chassis centre line.

The drilling of holes in the bolster may be left until other parts are made, with the possible exception of the elongated holes in the cross bars, by which it is to be secured to the cross members of the sub-frame. It will be seen that I have considered it advisable to add raised facing strips on the

Side Frames

These are cut from ⅛ in. steel plate (hard brass may be used as an alternative) to the shape and dimensions shown in Fig. 111. The pair of plates may be clamped together for cutting out, but before doing so, lay each one in turn on the surface plate, or other flat surface, to make certain that they are quite flat and free from "wind." If they

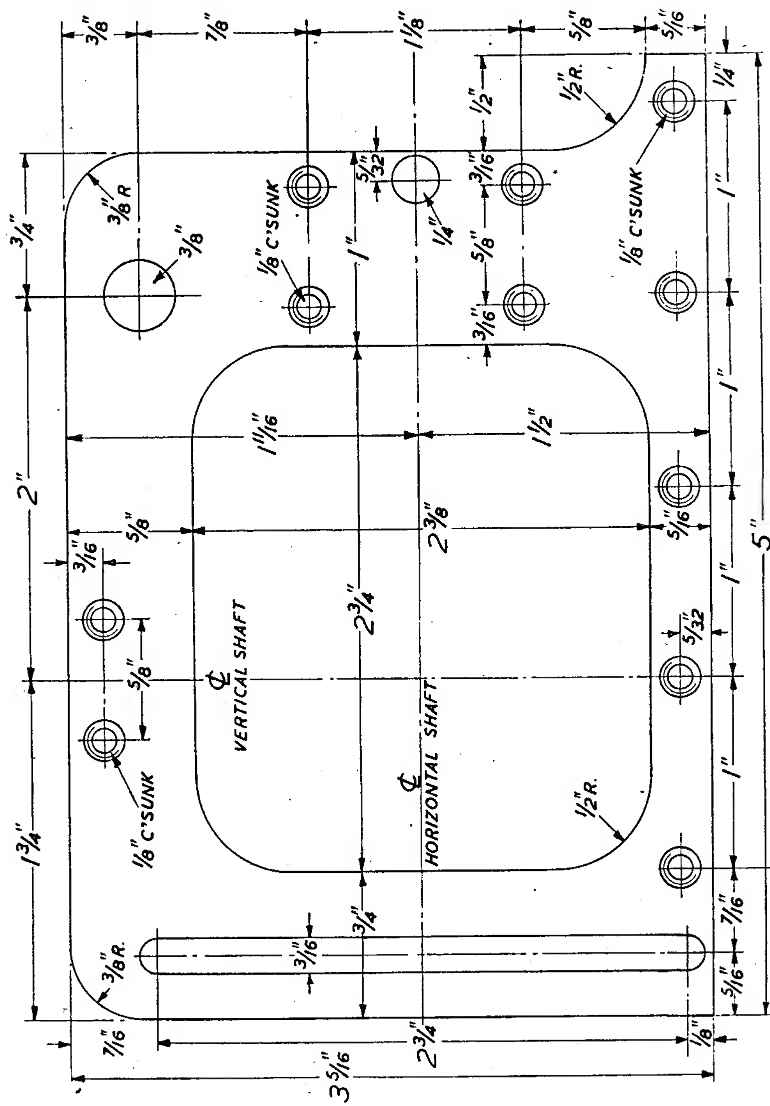


Fig. 111. Outline of side frame plates of transmission gear for "1831."

bars where these holes occur, partly to avoid weakening the bars by cutting into the corner fillets, as would otherwise be necessary to form a true seating for the bolts. If the bolster is built up, it is probable that only a very slight fillet will be formed in the corner, and thus the raised facing will not be necessary.

do not bed down truly, correct any error which is found to exist by a few judicious blows with a mallet in the appropriate spots (*not* on the surface plate!). It is quite hopeless to try to build up a true structure with twisted frame plates, and attention to this matter in the initial stages will save a lot of trouble later on.

Mark out the shape as accurately as possible on one of the plates, and clamp them together with toolmakers' clamps or other convenient means while drilling three or four of the screw holes in appropriate places for the insertion of temporary bolts, which are handier and more reliable than clamps for ensuring the true register of the plates during the cutting out operations. The centre hole is most easily cut out by drilling a row of small holes as close together as possible, and then opening them out so that they break into each other. An old or not highly valued drill should be used for the latter operation, for obvious reasons.

This procedure is better than drilling the holes fairly close together and then breaking them out by using a chisel on one or both sides of the plates, because, even with the greatest care, there is a great risk of distorting and buckling the plates in this way. The cutting action of a chisel depends entirely on the displacement and local deformation of the metal, so that it is better suited to trimming the edges of a plate than for cutting a piece out of the middle. I know one or two people who habitually cut out frame plates with a hammer and chisel, and who will, no doubt, be prepared to defend their methods, but they have acquired the necessary skill to avoid or correct the errors which are liable to arise, whereas I am trying to instruct the novice who has never tackled the job before.

The long slot near the vertical side of the frame plates should be cut as straight and as truly parallel as possible, either by drilling a row of holes and joining them up by filing, or, better still, by end-milling. It is not a difficult matter to carry out the latter operation, even when no special milling appliances are available, as the plates can be clamped to the side of an angle-plate mounted on the lathe cross slide, and operated on by an end-mill running in the chuck. A piece of wood should be interposed between the work and the angle-plate, so that the cutter can be fed right through without damaging the latter.

When the plates are completely shaped and drilled, separate them and remove all burrs, also re-check their flatness on the surface plate. Mark them clearly to show which is to be used as left and right side respectively, also outside and inside, so that no unfortunate mistakes arise when countersinking the screw holes. They may then be clamped to the sides of the bolster, lines being scribed along the latter at a distance of 5/16 in. from the top edge to locate the position of the bottom edges of the plates; the parallelism of the top edges may also be checked by sighting across them. A $\frac{1}{8}$-in. drill is then run into each of the screw holes, and into the bolster sides, to the depth of the lips, to locate the position of the tapping holes, which are then followed through and tapped for $\frac{1}{8}$-in. countersunk screws.

(*To be continued*)

"L.B.S.C."

(*Continued from page* 516)

was standing by the cab, and he winked and said loud enough for the kid to hear, 'I believe he's afraid of her.' Gorlummy, that did it; it was just as though somebody had given young Curly an electric shock. He slammed back the brake valve to full release, touched the whistle and opened the regulator, stood holding it whilst we crossed the bridge, with his head bent as if he were listening for something; then as we started up the grade, he got the lever back next to middle by throwing all his weight against it, gave her all the regulator, shut the blower, and turned to me with that shy manner he had, and said, 'Please, Mr. Jones, *you* don't think I'm afraid of her, do you?' Me and my mate had to laugh, we couldn't help it. It broke the tension. Curly was never scared again, he'd do anything with the engine after that."

The next thing I actually do remember was passing the junction distants at the bridge over Bidwell Street, and noticing they were both "on"; but I took no notice of that, because the driver had told me that they were never pulled off for a train terminating at Peckham Rye. I looked out for the home signals as we passed under the L.C. & D.R. bridge at Albert Road, and saw that the South London home signal was off, so I shut off at the coal yard, and made my brake application; but I made a mistake when stopping, by getting the train too far down the platform, so that the guard's brake was level with the ticket barrier, instead of the first class carriages. Not that it mattered, for there were only about a dozen passengers left in the train. The driver then told me about how to judge stopping points when running bunker first and standing in the cab on the side away from the platform. He pointed out an advertisement a little way back on the opposite platform, and said that if I stopped with the cab opposite "Hudson's Soap" next time, the carriages would be just right, with the firsts opposite the ticket barrier. Well, space is all used up this week; but circumstances and the K.B.P. permitting, I won't leave it so long before telling you what happened during the rest of that evening.

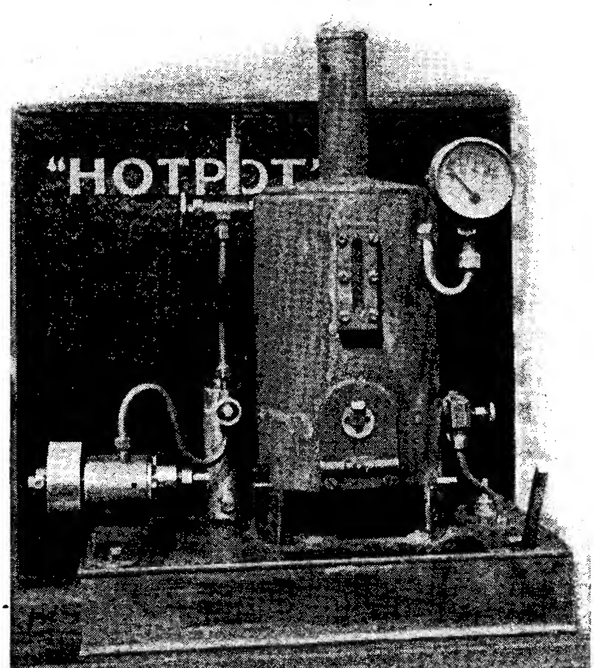
"HOTPOT"

By EDWARD ADAMS

An Experimental Boiler and Engine

A MOST interesting side to our art and craft of model making is the freedom to experiment with what we may think are new and untried mechanisms; and after a period of working from blue prints and the designs of others, the adventure of contriving for ourselves, of trying out our ideas, can be absorbing and often an exciting contrast and relaxation. It is then we meet new difficulties and maybe overcome them.

Having developed some vein of thought, we may find that it is ancient history, has been done before, and done better. In this spirit, then, the boiler and engine illustrated were constructed; that they function is one of the hazards of experiment, but it was good fun making them.



Feeling the need for a small but powerful steam generator for trying out experimental engines, pumps and other gadgets, the boiler was first built. The barrel—which is $3\frac{1}{2}$ in. diameter and $6\frac{1}{2}$ in. high—and the tubes were salvaged from a locomotive boiler which had to be scrapped owing to an inaccessible leak in the combustion chamber. The firebox is water-jacketed and has five $\frac{1}{2}$-in. diameter water-tubes across it in two heights, the upper and lower tiers being staggered, all inclined slightly to promote circulation.

Twelve $\frac{3}{8}$-in. diameter flues connect the firebox with the smokebox, the latter being formed by setting the tube plate $\frac{1}{2}$ in. down in the barrel. In the smokebox, directly under the chimney, is a combined fitting for steam outlet and the blower valve and jet; the valve spindle extends to the outside. A coil for superheat takes two turns above the flues before emerging to the safety-valve and steam-valve.

The fire-door—once a back-flap hinge—has a hopper attached on the fire side, and the method of firing is to drop coal in this and give the door a smart rap, which shoots the coal into the fire and returns the door to the open position for more fuel. The weight of the hopper keeps the door in position when closed. A small rotative hit-and-miss regulator in the fire-door controls the amount of air admitted above the fire, and serves as fire-door handle.

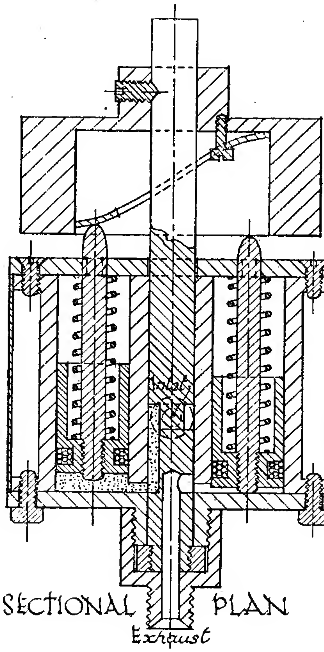
The grate is built up of strip steel and spacers in the usual way and is easily removed by drawing out the two cross-rods on which it rests; the grate then drops and can be drawn through the opening under the fire-door.

Although the boiler makes steam very rapidly owing to the large amount of heating surface in proportion to the volume of water, the water level can easily be maintained by a hand-operated pump of the tender type submerged in the water tank forming the base, and the water is warmed by its proximity to the fire. A cork float in the filling-cap shows the water-level in the tank.

The water gauge has so far proved to be quite satisfactory, the water-level is easily read and the risk of breaking under pressure seems very small. Oiled brown-paper washers on both sides of the $\frac{1}{8}$-in. thick glass, which happens to be sheet, not plate glass,

allows small movements due to temperature changes. The cover and glass are easily removable for cleaning by taking out six screws.

Between the boiler and engine can be seen the displacement lubricator of generous

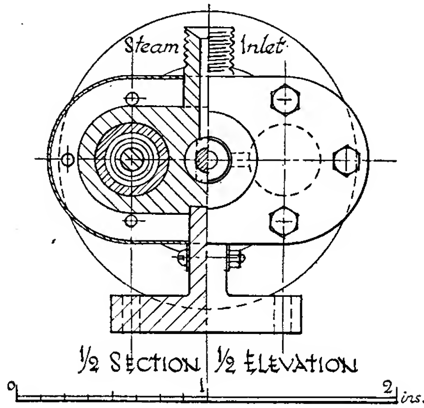


proportions, having filling-cap, draw-off cock and needle-valve.

No attempt has been made to simulate the appearance of a large boiler or to work to a scale, the object was to produce a sound working proposition with reliable and accessible fittings. The name "Hotpot" is no exaggeration.

Slotted holding-down plates will adjust to almost any shape of engine base.

A timber box, with hinged lid and fastener, keeps dust away and reduces rust and tarnish. I have made boxes for all my models and find them well worth while.



The engine shown in the photograph and drawing is one of several, either made or contemplated, and is a revolt against the principle of reciprocation. It runs at a great speed and makes a rare clatter. The hardened ends of piston-rods impinge on an inclined plate, also hardened and highly polished, inside the flywheel, and rotate it; light springs help to return them.

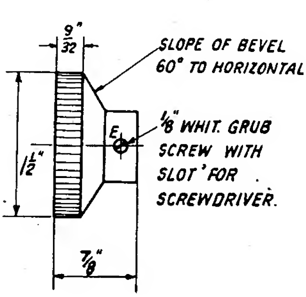
The valve-gear could not be simpler, being non-existent; steam is admitted and released from the cylinders by flats and a port drilled in the shaft itself.

The compactness of this engine and its low c.g. make it ideal for a boat, but I doubt if the power output would compare favourably with the steam consumption.

A MICROMETER INDEX

THIS fitting for my 4-in. Drummond lathe was made from Muntz metal and proved a quite straightforward job; a ⅞-in. length, overall, was bored out to fit snugly over the hand-wheel stub. The slide screw having 12 threads to the inch, the rim of index theoretically should have had 1,000/12, giving 83 divisions.

It was divided into 80 parts, using the 40-tooth change-wheel to put on the first 40 divisions, and then by advancing half a tooth and



Details of the index.

re-marking again, the subdivision produced 80 marks in all.

The metal, being soft, was easily marked by using a sharp tool in the tool-post and drawing along the surface of disc land with lead screw handle.

The index was secured by the ⅛-in. Whit. grub screw at *E*, a very small indentation being made on wheel stub to receive and locate the screw.

A zero line on front plate of slide completed the fitting.—HAROLD V. EDDY.

*Small Capstan Lathe Tools

Notes on "tooling up" for repetition work, with special application to the small capstan attachment recently described in the "M.E."

By "NED"

THE majority of the components produced on small capstan lathes call for either internal or external screwcutting operations, which have to be carried out with a speed and efficiency comparable with those of the normal cutting operations in order to avoid undue delay and slowing-up of output. The methods of producing screws employed in normal practice include the use of more or less normal types of taps and dies, special "releasing" tap and die-heads, and generating methods, in which either single-point screwcutting tools or chasers are positively fed by means of an ordinary lead screw, or a hob attached to the tail end of the lathe mandrel. Occasionally some form of thread milling device is used for heavy or coarse-pitch screwing on a large capstan lathe, and there are also instances where thread rolling processes have been employed; but these are few and far between, and it is extremely unlikely that such methods will come within the scope of readers for whom these articles are intended.

Most small capstan lathes employ nothing more elaborate than solid taps and dies for all screwing operations; not necessarily from choice so much as necessity or economic expediency. Expanding tap and die-heads are wonderfully efficient tools, but quite apart from their high cost, which in many cases would render their use unprofitable for short runs of varied work, it is almost impossible to obtain them at present except for work of extreme urgency. In any case, internal screwing of small work cannot be carried out in this way, as the smallest "collapsing" tap will only deal with holes down to about 1-in. diameter. Furthermore, the room taken up by expanding die-heads is considerable, and even on certain types of regular production lathes—not the smallest of them, by any means—special devices have to be adopted to raise the die-head to clear the capstan slide as it swings round.

In these circumstances, it is not considered worth while to devote space to describing these devices in detail; if further information about them is desired, it may be found in THE MODEL ENGINEER handbook, "Capstan and Turret Lathes," which also includes some details of chasing and other generating methods of screwcutting.

Tap and Die Holders

The common types of holders for taps and circular dies, as applied from the tail-stock in centre-lathes, can be adapted for capstan lathes simply by making the shank of the holder to fit the capstan head socket.

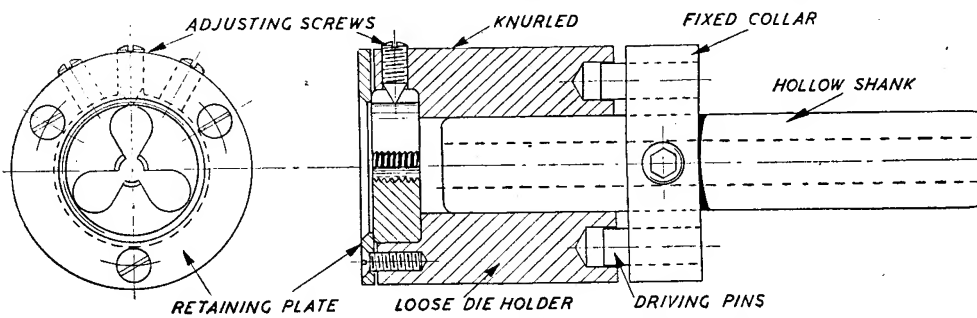


Fig. 21. Simple form of "slip" holder for small circular dies.

It is, however, very desirable, if not absolutely necessary, to arrange the holder so that it may be disengaged, to allow the free rotation of the tap or die, when the required length or depth of thread has been reached. This applies particularly when the thread is required to approach closely up to a head or shoulder on the work, or to the full depth of a blind hole, as the inertia of the running parts of the lathe makes it impossible to ensure that it will stop at exactly the right place, even under the most skilful control; and an overrun is more than likely to result in breakage of the tool, or even more serious damage to the lathe itself.

* *Continued from page* 477, "*M.E.*," *May* 14, 1942.

The simplest method of disengaging the screwing tool is by means of a two-part holder incorporating some form of positive engagement clutch, which can be uncoupled simply by the drawing apart of the two elements; in short, any one of the various forms of jaw or "dog" clutches. If the travel of the main part of the holder is limited, by appropriate setting of the capstan slide end-stop, or any other means, the loose die or tap holder will move forward on the thread when this point is reached, and eventually disengage the clutch. The tap or die will then rotate with the work until the lathe is stopped to enable it to be unscrewed by hand, or reversed so that it can be re-engaged and run back under power.

With this simple device, the length of thread cut depends on the position at which the endwise feed of the holder is stopped, *plus* the distance which the tap or die must move to disengage the clutch—in other words, the depth of the clutch jaws or pins. The general form of the holder is the same for either taps or dies, except for the provision necessary for the accommodation of these respective tools.

A Simple "Slip" Die Holder

In Fig. 21 is shown a form of holder adaptable to ordinary circular or "button" dies, which is very simple to make and entirely satisfactory in use. The shank of the holder is simply a length of round mild steel stock drilled through the centre to allow the passage of small screwed work, on which is pressed a collar, from the outer face of which projects two or more equally-spaced tool-steel pins. These engage in holes or notches in the back of the cylindrical die-holder, which is a free-running fit on the projecting end of the shank. The pins must be faced off dead square at the ends, and to exactly the same length, so that they disengage simultaneously as the die slides forward on the shank.

In some holders working on this principle, the die-holder, instead of being driven by pins or dogs, has an internal keyway which engages with a feather key fitted to the shank. This form is more compact, and may be fairly satisfactory in practice, but is less durable than that shown, as the key, being nearer the centre, takes a higher torque leverage than the pins employed in the other type, and it is not uncommon for the end of the key or keyway to get burred up or damaged as the drive is disengaged. Much the same applies to holders in which the driving element consists of a round cross pin driven through the shank, engaging a cross slot in the back face of the die-holder. There is a further objection to the use of a round cross pin, as it is liable to cause a sudden jerk forward of the die at the moment of disengagement, due to the wedging action of the rounded driving face of the pin; and this may cause damage to very delicate screwed work. The effect can, of course, be remedied by filing the pin D-shaped at its projecting ends, so that the front face is square and disengages cleanly and completely. These are small details, but experience in the setting of machines for all sorts of industrial production has proved that anything which cuts out potential causes of trouble, even in very minor points, or saves split seconds in setting or operating, is worth considering. For this reason, the form of holder shown, with the driving pins set in the collar, is strongly recommended. The pins may be very simply and quickly renewed if and when necessary, and their number may be increased, if desired, to deal with extra heavy stresses. It is not necessary to harden them, as a general rule, providing that they are made of good material, neither is it necessary to harden the engaging notches in the die-holder, though these measures may be adopted to improve the general quality and durability of the tool if desired.

A further point about this type of holder is that, as the die-holder is bound to be butted firmly back against the face of the collar when the thread is started, it is always held quite truly, even when the working clearance on the shank has become abnormal as a result of wear and tear.

Die Holder Design

The die holder is provided with a recess at the front to take standard circular dies, and equipped with the usual screws for adjusting them. Most of the work on small capstan lathes can be carried out with the popular 13-16-in. dia. range of dies, but it is, of course, practicable to bore the holder to take any other size that may be available. In some cases, provision is made for fitting more than one size of die in a holder, by the use of adaptors, but in view of the difficulty of holding these really securely and truly, it would be better, and entail little more work, to make separate holder elements, interchangeable to fit the same shank.

It is by no means easy to hold a circular die so that it is always presented quite truly with the axis of the work. Concentric truth might be assured if it were possible to make the diameter of the holder recess to fit the die closely; but this is not practicable with the simple form of dies, as they have to be capable of being expanded or contracted within certain limits by the adjustment screws. In many cases the die is forced out of truth by the screws, and there does not appear to be any simple way of providing a remedy for this. A slight degree of eccen-

tricity, however, is of much less practical importance than tilting of the die in the holder so that its axis is out of angular alignment with the work. The usual result of this fault, even when the main part of the die holder is accurately set and guided to travel truly axially, is to produce a "drunken" thread, or else one in which the flanks of the thread are unduly cut away and weakened.

To ensure that dies are held truly in the axial plane, some means of drawing them back so as to bed firmly into the bottom of the recess is clearly called for; but any device used for this purpose inevitably restricts the ability of the die to approach closely up to a shoulder, and for this reason is often found undesirable by tool setters. In a general way, however, some means of keeping the die true is a great asset to accuracy, and providing that it is capable of being detached when its use restricts the scope of operation, it is always well worth while.

In Fig. 20, it will be seen that the front of the holder is fitted with a thin flat washer, pulled up against the die by three screws. This method is as satisfactory as any other; but there is unfortunately one eventuality with which it is almost impossible to cope, namely, the case of the die which is initially inaccurate in respect of the squareness of the face with the thread. Such dies are all too commonly encountered; mainly due to the fact that, in the cheaper classes of such tools, it is common to finish the faces bright after hardening, on a linisher or similar rough surface grinder, in which there is no check on the production of errors of this nature. Assuming that the only dies available are found to be out of truth on the face, and that the work to be produced is exacting, they can be corrected by screwing them on to a true-running screwed spigot and trueing the faces in turn with a tool-post grinder.

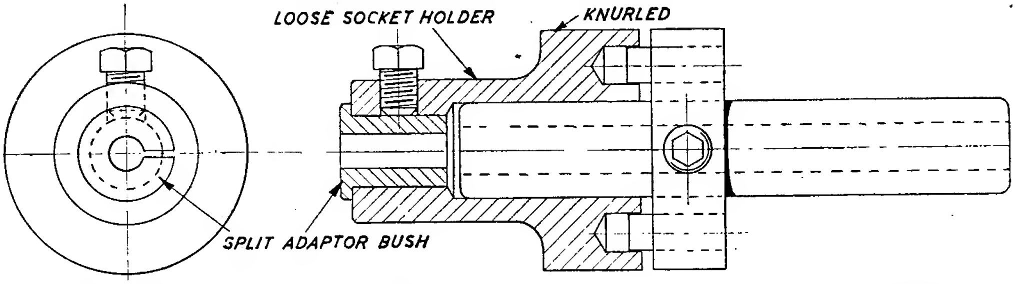


Fig. 22. Slip tap holder, with socket for split adaptors, to fit same type of capstan-head holder as Fig. 23.

Tap Holders

Any means whereby the various sizes of taps may be held truly and securely will be suitable for this purpose, if applied to a similar form of "slip" clutch holder as used for dies. The most common device in industrial use is a plain socket holder with a set screw, either made up as required to suit the size of tap in use, or fitted with adaptor bushes or split collets, which grip the tap by the pressure of the pinching screw (Fig. 22). It should be noted that most "machine" taps differ from those generally made for hand use in not having squared ends; sometimes they have plain round shanks, but more often are equipped with a single flat, or a "tang" like that of a Morse taper drill, to fit a special form of socket. If hand taps are used, as will usually be the case in the home workshop, the most satisfactory form of tap holder is one which will not only grip the round part of the shank to provide true axial guidance, but also provides positive engagement with the square to resist torque.

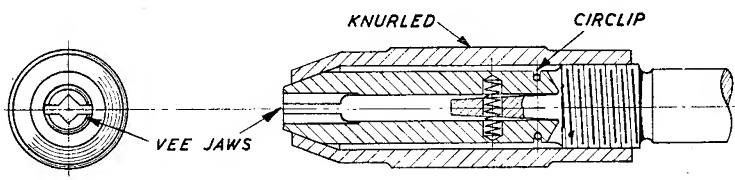
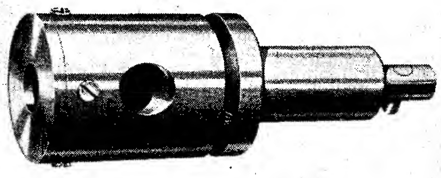


Fig. 23. Type of two-jaw chuck suitable for holding taps with squared shanks.

The more common forms of cheap drill chucks are almost useless to hold taps, as they do not provide a sufficiently firm grip to prevent rotation, even when screwed up almost to bursting point. A much more suitable form of chuck is the type which is employed in Tee-handled adjustable tap wrenches; it is similar in design to the chuck of a carpenter's brace, having two vee-grooved jaws hinged at the inner end

(Fig. 23). This type of chuck will hold a wide range of taps quite positively, but often leaves much to be desired in keeping them axially true. It is not certain whether chucks of this type are commercially available at present, but if not, they are not really difficult to construct.



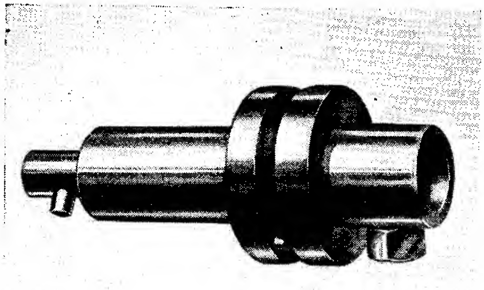
The "Euco" reversing clutch holder for circular dies.

"Euco" Tap and Die Holders

Messrs. Engineering Utilities, whose products have been referred to in a previous issue, also supply tap and die holders which conform to the principles referred to above, and are intended particularly for use on capstan lathes equipped with reversing gear to the mandrel. In these appliances, the part of the holder which is attached directly to the capstan head consists of a hollow shank with a broad flange, which in this case is termed the housing. A single clutch pin is fitted to the face of the flange, and engages with a hole in the back of the body, which incorporates the actual tap or die holder. This element has a central shaft which passes right through the tubular housing and has a cross pin through the end.

In this appliance, not only is provision made for driving the holder positively and disengaging it when necessary, but also for picking up the drive on the reversal of the lathe spindle, and backing it out under power as the capstan slide is withdrawn. This is effected by the engagement of the cross pin in the centre shaft with a notch in the rear end of the hollow shank.

The die holder is equipped with the usual three adjustment screws, and also a retaining plate to ensure that the die is held truly on the face. Holes are provided in the sides of the body for swarf clearance. The tap holder is of the plain socket type to take a range of adaptors. These tools are made with shanks of ¾ in. and 1¼ in. dia., to take dies up to 1 in. and 1½ in. maximum outer dia., and taps up to ½ in. and 1 in. maximum dia., respectively.



The "Euco" reversing clutch socket type tap holder.

(To be continued)

Preventing Explosions when Repairing Petrol Tanks

A GREAT many model engineers possess their own motor cars or motor cycles, and may have been troubled with a leaky petrol tank. Unfortunately, many accidents have occurred through mechanics and inexperienced motor owners endeavouring to solder leaky petrol tanks which contain small quantities of spirit or petrol vapour and employing such unneccessary heating appliances as paraffin or petrol blowlamps.

Before attempting to repair a petrol tank it is essential to steam it out thoroughly (or even to submerge it in water kept at boiling point for some time), the air inside the tank should then be scavenged out until the vapour is entirely removed. All traces of petrol vapour can be removed by utilising air from a compressor, or if this is not available, the foot pump or hand appliance used for inflating motor-car tyres may be employed.

It is not generally realised by many engineers that when petrol or other inflammable liquid has been completely poured from a tank, sufficient vapour is left inside to form an explosive mixture with the air which has entered the tank. In addition to scavenging the air from petrol tanks after the steaming process, safety-first methods suggest squirting fire-extinguishing fluid or pouring a small quantity of carbon tetrachloride into the tanks and allowing it to vaporise. These chemicals should be washed out after welding or soldering repair operations with petrol.

Not infrequently, petrol tanks get punctured and badly indented, especially after collisions. If the tank is holed, get a piece of thin sheet metal and place it in position over the hole. The piece of sheet metal should be carefully soldered around the edges and the superfluous solder filed smooth. The patch and the soldered joint, after repainting, should be practically indiscernible.
—A. J. T. E.

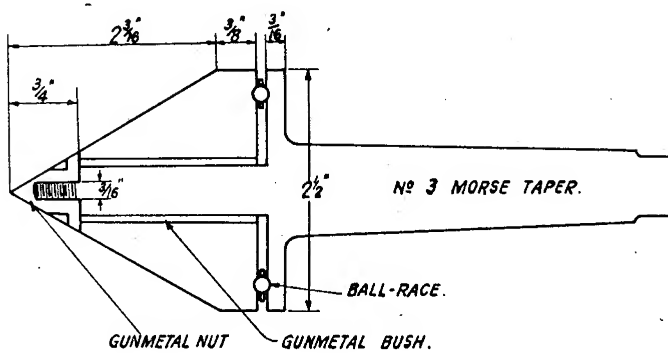
Letters

A Revolving Centre for Turning Tubes

DEAR SIR,—I read with interest a description of a revolving centre for turning tubes in THE MODEL ENGINEER for January 1st this year. I give herewith a drawing of one of my own construction which you may find of interest. The whole centre, with the exception of the bush and nut, was turned from a piece of 2½ in. shaft. The thrust is taken by a ball-race bought from a motor-cycle dealer. Little trouble spent in grinding a tool to the radius of the balls, and care in cutting the grooves for the race to run in, will be amply repaid by sweet running. Lastly, the gunmetal locking-nut must tighten up on the arbor, leaving only two or three thou's. clearance. The nut is slotted to fit a 3/16 in. spanner.

Yours sincerely,

Herts. A.T.



The 17-Hole Division-plate

DEAR SIR,—One cannot let pass without comment the opening statements of Mr. F. O. Brownson in his entry for your Division-plate Competition.

In common with many other useful numbers, "π" cannot be expressed by any number, integral or fractional; faced with this fact, mathematicians evolved the means of computing their values to any degree of accuracy required. Could we ask more? Where is the "demonstration of the short-comings" of a science to which engineering is in eternal debt?

Yours faithfully,

Rugby. "CASSIUS."

Model Fire-hole Doors

DEAR SIR,—On page 389 of your issue of April 23rd, reference is made to the fire-hole door of the boiler as arranged by "L.B.S.C." for "Molly." A good practical solution is shown, but this difficulty reminds me that 60 years ago I had a catalogue as issued by Mr. R. A. Lee, of 76A, High Holborn, London, W.C., containing 64 pages with 110 illustrations for 6d., post free. My copy of this has long since disappeared, but a contemporary advertisement informs me that the contents included :—(1), A 2-guinea lathe with Cyclops foot motor; (2), A shaping machine for attachment to ordinary lathe and slide rest at one quarter usual cost; (3), Working model steam engines and locomotives from the smallest size to 15 horse power; (4), Paddle and screw steam boats from 1s. to 37 guineas; (5), Sailing boats; (6), Complete sets of engine castings from 2s., with improved tenon or chuck pieces on all parts requiring to be turned; (7), Complete set of castings, forgings, and materials for the 8 ft. Great Northern Railway express passenger engine to a scale of one inch to the foot: comprising 440 pieces for £7 10s. 0d., and seven working drawings to full model size at £1 1s. 0d.

With the boiler materials for this was included a Lee "registered" fire-hole and door described as rendering it, "as nearly as possible in a model" self-feeding. No particulars or sketch of this was given, but the above note by "L.B.S.C." reminded me of it, and some of your correspondents may have further information.

Yours faithfully,

St. Helens. JAMES W. GLOVER.

Lead and Pre-admission

DEAR SIR,—"L.B.S.C.'s" very interesting explanation on page 447 of the May 7th issue, regarding the difference between lead and pre-admission, recalled to my mind the discussions which arose when a certain gentleman well known in the engineering world was reputed to have said words to the effect that useful expansive working in a tiny model locomotive cylinder could be regarded as "pure rubbish." Now, supposing such working is "pure rubbish," how is it that when a tiny engine is altered from a "no leader and small porter" into a "large porter and great leader," as advocated by "L.B.S.C.," the effect is to produce a successful engine using less fuel and water and giving much more power with a comparative short cut-off? Does any of the power come from the expansive power of the steam which has been let into the tiny cylinder *quickly* and at the right time? It

seems to me that to suggest that any power worth speaking about can be obtained from the expansion of the amount of steam which has been let into a cylinder say of 7/16 in. bore by $\frac{3}{4}$ in. stroke and which, by the way, was perhaps cut off at 30 per cent. of the stroke is rather " far fetched," and, furthermore, with an initial boiler pressure of only about 60 lb., I do not believe that any power comes from the expansion of the steam but from the initial boiler pressure only, which, when applied to the piston *very* suddenly and with full force, gives it a terrific clout ; and I suggest that it is this clout which does all the work and that we gain little or nothing from the expansive effect of the tiny volume of steam. In other words, we drive the piston down the cylinder by a clout and *not* by sustained pressure.

I admit that I am not qualified to argue the matter scientifically and fear, therefore, that I may be talking " pure rubbish."

Yours faithfully,

Stanford-le-Hope. C. COURTICE.

[If our correspondent's surmise is correct, we should have expected to find that the valve-gear and other wearing parts knocked themselves to pieces in a very short while. This, however, is exactly the reverse of what actually happens, which seems to suggest that not only is the steam being used expansively, but that the impulses on the pistons are more evenly applied. —Ed. "M.E."]

Clubs

York and District Society of Model Engineers

Next meeting, Friday, June 5th, 7.30 p.m., at "The Bay Horse Hotel," Monk Bar.

Hon. Sec., H. P. JACKSON, 26, Longfield Terrace, York.

The City of Bradford Model Engineers' Society

The next meeting of the above Society will be held on Thursday, June 4th, Channing Hall, at 7.30 p.m., Open Meeting. These meetings are greatly in favour with a large number of our members; there are always some "bits and pieces" brought along, views, etc., exchanged, and interest is kept at a high level.

Sunday, June 21st, Channing Hall, at 10.30 a.m., a talk will be given by Mr. W. Wood on Press Tools. Mr. Wood is employed on this class of work, so knows his subject very well.

During the months in which double summer time operates, meetings will be held on the first Thursday, and third Sunday of each month, at 7.30 p.m. and 10.30 a.m. respectively.

We extend a warm welcome to members of H.M. Forces stationed in Bradford, and who are interested in model engineering, to attend any of our meetings.

Hon. Sec. and Treasurer, G. BOWER, 33, Moore Avenue, Wibsey, Bradford.

Bolton and District Society of Model Engineers

The next meeting will be held on Sunday, June 7th, at 2.30 p.m., at Corporation Chambers, Corporation Street. Will all members please attend, or let the Secretary know what models they have for the exhibition to be held on Saturday, June 13th.

Hon. Sec., L. SHEPHERD, 45, Darwin Street, Halliwell, Bolton.

West Midlands Model Engineering Society (Wolverhampton Branch)

The next meeting of the above Society will be held at the "Red Lion Hotel," Snow Hill, on Wednesday, June 3rd, at 7.30 p.m.

At this meeting a date will be fixed to visit the works of Mr. N. Harris, at Bilston. Friends and visitors are cordially invited.

Hon. Sec., F. J. WEDGE, 13, Holly Grove, Penn Fields, Wolverhampton.

The Kent Model Engineering Society

The future meetings of the Society will be held on Tuesday evenings instead of Sunday mornings. These will commence at 7.30 p.m., and be held at Sportsbank Hall, Catford, S.E.6. At the next meeting, each member is asked to bring some piece of work and give a ten-minute talk describing its construction.

June 7th, an all day track run, commencing 11 a.m. ; the new track extension is well under way, and it is hoped to have an additional eighty feet of track in operation.

Particulars of membership can be obtained from Hon. Sec., W. R. COOK, 103, Engleheart Road, S.E.6.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to Percival Marshall and Co. Ltd., Cordwallis Works, Cordwallis Road, Maidenhead, Berks.

All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," Cordwallis Works, Cordwallis Road, Maidenhead, Berks.